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ORBITS OF THE SPECTROSCOPIC COMPONENTS OF BOSS 5173

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This star ($\alpha=20^{h}\ 06^{m}$, $\delta=+26^{\circ}\ 37'$, magnitude 5.46, type A) was announced a spectroscopic binary by Adams in *Publications of the Astronomical Society of the Pacific*, June, 1915. He stated that the hydrogen lines showed great variations in width and intensity due probably to the presence of two spectra, there being a relative displacement of the lines of 150 km. on the first plate. On our taking up the determination of the star's orbit, Professor Adams kindly furnished the measures of three plates which are given below.

The star has been one over which the writer has expended a great deal of time, due in part, and possibly wholly, to the uncertainty of the measures. The period and general form of the velocity curves were readily obtained in the autumn of 1916, but when it came to a determination of the elements there appeared to be a difficulty. In these cases where both spectra are recorded, two curves are obtained for which the period, eccentricity, velocity of the system, and periastron passage must be identical and the longitudes of periastron must differ by 180 degrees. With the exception of the velocity of the system all the elements agreed, but in the case of this element there was a difference of some 10 or 15 km. as derived from the two curves. Of course a kind of agreement could be forced when a common value for the γ-velocity was adopted, but it was so very much inferior to the agreement when distinct values were adopted that it was felt that there was something wrong. Several least-squares solutions were put through, but the discrepancy persisted, and it was felt that more observations should be secured. In all, some 75 plates have been secured, but on about a dozen the lines are so hopelessly bad that the plates were discarded, and only 62 have been used in the final determination. The later observations minimize to some extent the discrepancy, but cannot be said to remove it entirely. However, when one reviews the plates and sees what ill-defined lines the velocities are based upon and, further, considers that for about half the period the lines are partially superposed, making measurement impossible, it would appear that the best of agreement cannot be hoped for. Consequently, since a system with different values for γ for the two components would be physically impossible, it seems better to go on the assumption of a common velocity and derive the best elements possible, even though better agreement can be secured when different values for each are used.

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ECOLE POLYTECHNIQUE BIBLIOTHEQUE

LINES USED IN BOSS 5173

Line	n	Residual		Correction to λ	Wave-Lengths Used
		Numerical	Algebraic		
4584·018	19	14·8	+ 6·3	−·096	4583·922
4572·190	9	10·2	+ 3·9	−·060	4572·130
4549·743	64	10·4	− 0·7	....	4549·743
4534·158	15	9·4	+ 2·4	−·036	4534·122
4522·908	4	14·3	− 9·1	+·137	4522·731
4520·397	8	7·9	− 0·8	....	4520·397
4501·417	2	12·5	− 4·5	+·068	4501·485
4481·477	83	11·3	+ 4·0	−·060	4481·417
4415·345	11	9·6	+ 6·9	−·102	4415·243
4404·861	5	7·5	− 3·5	+·051	4404·912
4395·155	5	8·7	− 6·2	+·091	4395·246
4351·977	22	13·3	− 5·0	+·073	4352·050
4340·645	48	10·7	+ 0·1	....	4340·645
4325·698	41	12·8	− 4·6	+·066	4325·764
4315·178	5	8·3	+ 3·1	−·045	4315·133
4307·974	39	10·5	− 0·5	....	4307·974
4300·000	9	13·2	+11·0	−·158	4299·842
4294·359	6	6·2	− 2·6	+·037	4294·396
4271·675	44	9·0	+ 2·4	−·034	4271·641
4260·537	7	9·1	− 0·8	....	4260·537
4250·586	6	9·7	+ 3·8	−·054	4250·532
4236·000	19	14·1	− 9·4	+·133	4236·133
4233·425	36	10·4	+ 0·1	....	4233·425
4227·107	25	13·4	+ 0·6	....	4227·107
4215·733	18	10·2	+ 6·0	−·084	4215·649
4202·366	5	7·0	+ 1·9	....	4202·366
4198·677	10	8·9	+ 7·1	−·100	4198·577
4143·839	33	10·4	+ 1·0	....	4143·839
4101·898	9	15·8	+ 8·3	−·114	4101·784
4077·862	30	10·0	+ 1·2	....	4077·862
4071·865	16	16·5	− 8·8	+·120	4071·985
4063·730	24	9·6	− 4·0	+·054	4063·784
4045·940	56	11·0	− 5·1	+·069	4046·009
4005·414	14	12·6	− 4·6	+·062	4005·476
3933·825	7	9·4	− 2·2	+·031	3933·856

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ECOLE POLYTECHNIQUE BIBLIOTHEQUE

OBSERVATIONS OF BOSS 5173

Plate	Date	Julian Day	Phase	Component I			Component II		
				Vel.	Wt.	O–C	Vel.	Wt.	O–C
	1914								
Mt. Wilson	June 12	2,420,296·973	1·661	−85·0		0·0	+ 64·0		− 2·0
"	July 12	326·827	3·567	−37·0					
"	Aug. 4	349·791	7·899	−40·0					
	1915								
7194	Sept. 2	743·624	1·144	−86·9	3	− 6·9	+ 65·0	2	+ 5·0
7308	" 30	771·502	1·074	−87·6	3	− 9·9	+ 60·5	2	+ 3·2
7327	Oct. 10	781·531	1·787	−91·9	4	− 0·1	+ 63·1	2	−10·2
7347	" 16	787·486	7·742	+38·9	3	− 7·3	− 84·8	3	− 5·8
7379	Nov. 6	808·510	0·818	−66·2	2	+ 3·8	+ 53·1	1	+ 5·1
7409	" 16	818·443	1·435	−93·5	2	− 6·9	+ 42·8	2	−15·2
7425	" 24	826·464	0·140	−21·5					
7435	Dec. 1	833·519	7·195	+52·3	5	− 8·3	−103·6	2	− 8·6
	1916								
7472	Jan. 6	869·446	5·858	+43·2	2	−10·9	− 83·4	2	+ 3·0
7479	" 13	876·452	3·548	−23·7					
7640	May 7	991·838	7·142	+62·3	5	+ 0·3	− 78·9	2	+17·1
7648	" 9	993·850	9·154	− 8·9	7				
7651	" 13	997·861	3·849	−16·8					
7667	" 24	2,421,008·850	5·522	+40·3	1	− 2·0	− 76·5	1	− 1·5
7670	" 25	009·847	6·519	+74·2	4	+ 9·2	− 88·8	3	+10·2
7676	" 28	012·831	0·187	−15·7					
7681	" 31	015·826	3·182	−70·5	3	− 3·5	+ 62·3		
7684	June 1	016·740	4·096	− 8·0	6				
7693	" 6	021·812	9·168	−17·3	10				
7697	" 13	028·817	6·857	+61·0	8	− 4·0	−111·4	4	−12·4
7698	" 17	032·498	1·222	−80·3	1	+ 1·0	+ 79·6	2	+17·0
7702	" 23	038·635	7·359	+64·8	5	+ 7·0	− 87·0	2	+ 4·0
7711	" 29	044·779	4·187	− 8·4	9				
7721	July 6	051·659	1·751	−85·8	6	+ 5·6	+ 68·3	3	− 5·0
7722	" 6	051·737	1·829	−89·2	6	+ 2·4	+ 78·2	3	+ 4·2
7727	" 11	056·711	6·803	+65·6	4	0·0	− 91·0	4	+ 8·0
7744	" 19	064·683	5·459	+46·7	7	+ 6·7	− 84·2	5	−11·2
7747	" 20	065·589	6·365	+64·8	4	+ 1·4	−101·0	3	− 3·0
7750	" 21	066·829	7·605	+61·0	4	+10·0	− 79·8	3	+ 4·2
7756	" 24	069·676	1·136	−76·1	7	+ 3·0	+ 48·2	5	−11·8
7760	" 25	070·736	2·196	−87·7	7	+ 3·3	+ 78·2	5	+ 5·2
7761	" 25	070·817	2·277	−85·1	5	+ 4·9	+ 57·2	3	−12·8
7770	Aug. 1	077·832	9·292	−18·7	7				
7772	" 2	078·683	0·827	−61·3	6	+ 8·7	+ 56·7	5	+ 7·7
7777	" 13	089·700	2·528	−92·4	4	− 6·4	+ 53·9	4	−13·7
7778	" 13	089·799	2·627	−90·8	4	− 6·8	+ 70·6	3	+ 4·6
7793	" 18	094·666	7·494	+43·9	4	−10·1	− 85·4	4	+ 2·6
7794	" 21	097·622	1·134	−73·9	3	+ 6·1	+ 59·2	3	− 1·2
7801	Sept. 6	113·607	7·803	+63·5	3	+ 1·5	− 85·4	3	− 8·4
7804	" 9	116·692	1·572	−97·7	4	− 7·7	+ 74·4	2	+ 3·4
7822	" 30	137·508	3·756	−22·2					
7836	Oct. 2	139·591	5·839	+59·4	4	+ 6·4	− 90·5	3	− 4·5
7847	" 4	141·507	7·755	+44·9	3	+ 1·0	− 77·9	3	0·0
7876	" 12	149·558	6·490	+54·7	3	−10·0	−112·5	4	−13·5
7888	Nov. 4	172·460	1·444	+67·8	2	− 4·4	− 82·6	2	+ 1·0

OBSERVATIONS OF BOSS 5173—*Concluded*

Plate	Date	Julian Day	Phase	Component I			Component II		
				Vel.	Wt.	O–C	Vel.	Wt.	O–C
	1916								
7915	Nov. 22	2,421,190·462	0·814	−27·9	......	....	....	......	....
7919	" 25	193·449	3·801	−28·0	......	....	....	......	....
7940	Dec. 16	214·445	6·165	+60·7	4	− 0·3	− 94·0	2	+ 1·0
7952	" 19	217·463	9·183	− 3·7	6	....	....	......	....
	1917								
8219	July 5	415·807	2·575	−78·4	4	+ 6·6	+ 54·6	3	−13·4
8233	" 22	432·751	0·887	−68·7	4	+ 3·5	+ 86·2	2	+35·7
8245	" 27	437·688	5·824	+72·1	2	+19·1	− 95·7	2	− 9·7
8260	Aug. 6	447·681	6·501	+65·6	2	+ 0·6	−102·0	3	− 3·0
8264	" 10	451·644	1·148	−88·3	2	− 8·3	+ 63·1	1	+ 3·2
8280	Sept. 3	475·682	6·554	+70·5	2	+ 5·5	−110·4	1	−11·0
8281	" 4	476·575	7·447	+47·7	1	....	....	......	....
8291	" 8	480·665	2·221	−122·1	2	−32·0	+ 45·6	1	−27·4
8295	" 11	483·705	5·261	+57·9	......	....	....	......	....
8306	" 24	496·623	8·863	−24·6	......	....	....	......	....
8311	" 26	498·654	1·578	−94·8	2	− 5·8	+ 67·6	2	− 3·4
8321	Oct. 15	517·563	1·855	−96·3	4	− 4·3	+ 96·0	......	....
8344	Nov. 10	2,421,543·492	9·152	−12·4	3	....	....	......	....

MEASURES OF BOSS 5173

λ	7194		7194		7308		7308		7327		7327		7347	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4481					−88·5	½	+101·4	¼	−58·1	¼				
4340	−93·2	¼	+61·2	¼	68·2	½	77·6	¼					+51·3	½
4325													59·6	½
4308									58·3	½			53·1	¾
4271									64·6	¼				
4236			77·3	½										
4233	83·4	¼	+79·8	½	63·1	¼			96·9	¼	+71·3	½		
4198	85·7	½							85·5	½				
4101													50·6	¼
4077					55·0	½	+66·4	½					73·6	¼
4063	64·6	½			81·7	¼			72·3	¼				
4045	−60·3	¼			−64·0	¼			80·1	¼			+72·0	½
4005									60·8	¼	93·8	¼		
3933									−77·8	¼	+94·0	¼		
Weighted mean	−76·80		+75·04		−70·22		+77·90		−72·55		+82·50		+58·98	
V_a	− 9·74		− 9·74		−17·15		−17·15		−19·06		−19·06		−19·80	
V_d	− 0·04		− 0·04		+ 0·04		+ 0·04		− 0·05		− 0·05		0·00	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	−86·9		+65·0		−87·6		+60·5		−91·9		+63·1		+38·9	

MEASURES OF BOSS 5173—*Continued*

λ	7347		7379		7379		7409		7409		7425		7435	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4584	....	...	....	...	....	...	−65·6	¼	+59·7	¼	....	...	....	...
4549	....	...	−38·2	½	....	...	....	...	....	...	+ 6·5	½	....	...
4534	....	...	45·6	½	....	...	60·3	¼	....	...	....	...	+70·6	½
4501	....	...	....	...	....	...	....	...	....	...	−12·9	½	....	...
4481	....	...	51·5	¼	+77·1	¼	99·0	½	....	...	+ 8·3	½	71·5	½
4340	−96·6	¼	24·9	¼	....	...	79·5	¼	53·5	¼	+ 1·8	½	....	...
4325	51·5	¼	33·3	¼	....	...	68·3	¼	....	...	− 0·9	½	93·1	¼
4308	46·2	¼	....	...	....	...	58·2	½	76·5	¼	+12·6	¾	66·0	½
4271	....	...	49·9	¼	....	...	....	...	....	...	....	...	43·3	¼
4260	....	...	....	...	....	...	....	...	....	...	....	...	90·5	½
4236	....	...	....	...	....	...	....	...	....	...	−13·1	¾	69·2	¼
4233	....	...	....	...	....	...	....	...	....	...	− 0·5	¾	....	...
4202	....	...	....	...	....	...	....	...	....	...	....	...	77·8	¼
4198	....	...	34·5	¼	....	...	66·4	¼	51·5	½	− 3·4	½	82·6	¼
4143	....	...	....	...	....	...	....	...	+90·1	¼	....	...	56·0	¼
4101	77·4	¼	−65·4	½	+72·0	¼	....	...	....	...	....	...	....	...
4063	....	...	....	...	....	...	....	...	....	...	−19·3	¼	....	...
4045	−52·1	¼	....	...	....	...	−70·0	¼	....	...	− 4·4	½	+72·7	¾
Weighted mean	−64·76		−44·76		+74·55		−72·48		+63·73		− 1·20		+71·65	
V_a	−19·80		−21·01		−21·01		−20·62		−20·62		−19·84		−18·83	
V_d	0·00		− 0·14		− 0·14		− 0·08		− 0·08		− 0·14		− 0·20	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	−84·8		−66·2		+53·1		−93·5		+42·8		−21·5		+52·3	

MEASURES OF BOSS 5173—*Continued*

λ	7435		7472		7472		7479		7640		7640		7648	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4584							− 5·0	¼						
4572									+45·4	¼	−117·6	¼		
4549							3·9	¼	41·3	½	95·7	¼	−27·5	¾
4534	−93·4	¼												
4520			+52·3	¾										
4481	94·3	¼	52·1	¼			12·2	¼	36·8	¾	83·7	¼	23·7	¾
4352							24·9	½					40·3	½
4340			50·0	¼					20·0	½			36·8	½
4325	62·6	½			−76·9	¼			51·9	½			17·2	¼
4308					65·2	½							19·7	½
4294									54·3	¼				
4271													29·4	¾
4250			39·0	¼	−77·8	¼								
4236			+75·1	¼										
4233							−19·0	¾					19·4	½
4227									46·5	¼	111·6	¼	22·8	¼
4215													27·2	½
4143													46·0	¾
4101											−88·1	¼		
4077									42·3	½				
4063									50·7	¼			44·0	½
4045	−92·5	¾							+47·2	½			29·3	½
4005													−11·6	½
Weighted mean	−84·34		+53·31		−73·30		−15·95		+41·91		−99·34		−29·21	
V_a	−18·83		− 9·61		− 9·61		− 7·23		+20·57		+20·57		+20·47	
V_d	− 0·20		− 0·24		− 0·24		− 0·24		+ 0·14		+ 0·14		+ 0·11	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	−103·6		+43·2		−83·4		−23·7		+62·3		−78·9		− 8·9	

MEASURES OF BOSS 5173—*Continued*

λ	7651		7667		7667		7670		7670		7676		7681	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4584											− 4·7	½	−50·2	¼
4572	−57·4	½												
4549	48·8	½	+ 3·0	¼			+79·4	½	−124·0	¼	50·7	½	87·8	¼
4534											41·7	½		
4481	34·2	½	− 0·3	¼	−98·9	¼	38·6	½	97·8	¼	33·4	½		
4352											50·3	½	105·3	¼
4340	25·1	½	+39·5	¼							39·5	½		
4308	35·1	½					34·0	¼	100·5	¼				
4294	36·2	½												
4271			+41·5	¼							21·4	½		
4236							85·3	¼						
4233	30·5	½									53·7	½		
4227	20·0	½											93·7	¼
4215	40·8	½					51·1	½						
4202			+ 2·1	¼										
4198			+30·3	¼										
4143			+27·9	¼							43·8	½	91·0	¼
4101											43·0	½		
4077	73·9	¼					39·9	½	−108·3	¼			88·9	½
4071											23·1	½		
4063	51·8	¼									29·8	½		
4045	−15·1	½	+24·0	½	−92·1	¼	62·2	½			13·6	½	−95·6	½
4005							65·4	½						
3933							+37·8	¼			−26·8	¼		
Weighted mean	−36·91		+21·33		−95·50		+55·33		−107·65		−34·09		−88·53	
V_a	+20·28		+19·20		+19·20		+19·06		+19·06		+18·65		+18·24	
V_d	+ 0·09		+ 0·04		+ 0·04		+ 0·04		+ 0·04		+ 0·06		+ 0·06	
Curv.	− 0·28		− 0·28		− 0·28		+ 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	−16·8		+40·3		−76·5		+74·2		−88·8		−15·7		−70·5	

MEASURES OF BOSS 5173—*Continued*

λ	7681		7684		7693		7697		7697		7698		7698	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4584			−33·8	½	−37·3	¼	+20·3	¼						
4572					23·7	¼								
4549			34·0	½	27·8	¾					−94·4	¼	+80·4	½
4534			30·7	½	29·6	¼								
4522					27·9	¼								
4520					31·6	¼	36·8	¼						
4481			12·6	¾	20·7	¾	42·5	½	−120·1	¼	104·6	¼	77·0	¼
4415							35·6	¾						
4404					41·9	¼								
4395					48·0	¼								
4352					46·0	¼	30·8	¼	148·7	¼				
4340					29·4	½	44·6	½	149·2	¼				
4325					40·6	¼	43·6	½						
4315					26·3	¼								
4308					40·0	¼	27·6	¼						
4300					43·4	¼								
4290					27·7	¼								
4271			10·1	½	17·6	¼	53·9	½	107·6	¼	86·0	¼	52·0	½
4236			14·3	½	24·6	¼	40·8	½						
4233			30·1	½	27·9	¼					−94·3	¼		
4227	+70·1	¼			19·3	½							+49·0	¼
4215			28·9	½	58·1	½	64·4	½	132·0	¼				
4143	49·8	¼	46·2	½	35·2	¾	57·7	½	129·4	¼				
4101							71·3	½						
4077	26·8	¼	18·8	½	56·6	¼	28·6	¼	110·7	¼				
4071							19·6	½						
4063			24·2	½	35·9	¼	45·3	½						
4045	+30·6	¼	36·1	½	41·1	¾	55·9	½	−115·7	¼				
4005			−22·2	¼	42·6	¼	+63·7	½						
3933					−40·5	¼								
Weighted mean	+44·32		−25·91		−34·14		+45·54		−126·68		−94·82		+65·07	
V_a	+18·24		+18·02		+17·10		+15·62		+ 15·62		+14·65		+14·65	
V_d	+ 0·06		+ 0·18		+ 0·05		− 0·08		− 0·08		+ 0·16		+ 0·16	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	+62·3		− 8·0		−17·3		+61·0		−111·4		−80·3		+79·6	

MEASURES OF BOSS 5173—*Continued*

λ	7702		7702		7711		7721		7721		7722		7722	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4584					−30·1	½								
4549	+42·3	½	−107·3	¼	33·0	½	−99·5	½						
4481	30·8	¼	107·2	¼	13·4	¾	105·7	½	+54·8	¼	−103·0	½		
4404					24·5	½								
4395					10·5	¼								
4352							76·3	½	51·9	¼				
4340	73·0	½	103·8	¼	14·4	¾	77·6	½	56·6	¼	113·0	¼	+61·0	¼
4325					25·0	½	106·9	¾	64·5	½				
4315							85·6	½	63·7	¼				
4308	53·6	¼									115·0	¾	76·5	¾
4300					14·4	½								
4271	51·5	¼	−82·3	¼	10·4	½					102·9	¾		
4260							95·8	½						
4250	42·9	¼			7·5	½								
4236	42·0	¼												
4233					22·1	½	112·3	½			71·6	½	64·7	½
4215	46·8	¼			18·2	½					88·6	½	80·3	¼
4202	59·5	¼												
4143	71·7	¼			32·7	½	94·3	¼			101·7	¾	77·0	¼
4101					7·9	½								
4077					20·4	½	89·7	¼			90·6	½	+56·5	½
4071	52·3	¾							+56·9	¼				
4063					24·0	½								
4045	+40·6	¼			25·6	¾	81·6	½			−94·3	½		
4005					−15·0	½	−107·3	½						
Weighted mean	+ 51·65		−100·15		− 19·56		− 95·08		+ 58·97		− 98·40		+ 68·96	
V_a	+ 13·20		+ 13·20		+ 11·45		+ 9·45		+ 9·45		+ 9·45		+ 9·45	
V_d	+ 0·24		+ 0·24		0·00		+ 0·14		+ 0·14		+ 0·04		+ 0·04	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	+ 64·8		− 87·0		− 8·4		− 85·8		+ 68·3		− 89·2		+ 78·2	

MEASURES OF BOSS 5173—*Continued*

λ	7727		7727		7744		7744		7747		7747		7750	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4584	+64·6	½	−77·5	½										
4549	52·6	½	95·1	¼					+31·6	¼	−87·9	¼		
4534									50·4	¼	116·0	¼		
4481	83·6	½	93·3	¼	+29·2	¼	−92·0	¼	97·3	¼	91·4	¼	+71·3	½
4415					39·3	¼	90·3	¼						
4352					52·0	¼			49·5	¼	145·5	¼		
4340					35·8	½	91·6	¼					34·0	¼
4325	43·2	¼	114·6	¼	41·9	½	80·6	¼						
4308	48·2	½							50·2	¼			50·5	½
4300					37·3	¼	100·2	¼						
4294	50·6	½			43·1	½							62·1	½
4271	64·9	½	103·6	¼	30·0	½	91·2	¼	57·1	½	105·8	½	47·9	½
4260									50·6	¼				
4233									55·5	¼	−89·4	¼	74·1	½
4227					30·0	½	88·2	½	84·6	¼				
4215					61·5	¼	93·9	¼						
4143					56·6	¾			78·0	¼				
4077					29·6	¼	84·0	’						
4071									64·0	¼				
4063					48·1	¾			68·4	¼				
4045	+40·1	¼	−129·1	¼	+39·1	¾	−85·1	½	+45·9	¼				
4005													24·9	¼
3933													+69·6	¼
Weighted mean	+ 58·00		− 98·68		+ 41·66		− 89·20		+ 60·00		−105·80		+ 56·90	
V_a	+ 7·87		+ 7·87		+ 5·26		+ 5·26		+ 4·90		+ 4·90		+ 4·53	
V_d	+ 0·06		+ 0·06		+ 0·07		+ 0·07		+ 0·18		+ 0·18		− 0·17	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	+ 65·6		− 91·0		+ 46·7		− 84·2		+ 64·8		−101·0		+ 61·0	

MEASURES OF BOSS 5173—*Continued*

λ	7750		7756		7756		7760		7760		7761		7761	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4584							−96·1	½	....	....	−82·6	¼		
4549			−60·6	½	....	....	84·2	½	+83·4	½				
4534							88·2	¼	98·6	¼				
4522													+35·4	¼
4520					+64·5	½	....	....	66·0	½	....	....	45·9	¼
4481			86·0	½	....	....	100·4	¾	61·8	¼	89·1	½		
4415									79·7	½				
4395			85·0	½	....	....	81·3	½						
4352					49·4	½								
4340			84·0	½	....	....	....	....	....	....	65·7	¼		
4325			82·2	½	19·0	½	....	....	....	....	120·3	¼	77·8	¼
4315			95·5	¼										
4308					62·5	¼	87·0	½	....	....	99·9	½	77·4	¼
4294			....	....	....	....	....	....	....	....	....	....	45·6	¼
4271	−106·3	½	70·6	½	37·6	½	84·9	¼	77·6	¼				
4236					36·0	¼								
4233	76·4	¼	74·0	½										
4227		....	87·6	¼	74·6	¼	120·9	¼	62·1	¼	72·0	¼		
4215							93·5	½	69·6	¼				
4143			91·6	¼	83·0	¼	....	....	....	....	89·6	¼	75·5	¼
4077							86·0	¼	+75·8	¼	....			
4071	−65·4	½	75·6	¼	....	....	....	....	....	....	....	....	+23·5	¼
4063	....	....	85·4	¾	29·7	½	....	....	....	....	....	....		
4045	....	....	−71·8	¾	+31·1	½	74·2	¾	....	....	78·2	½		
4005	....	....	....	....	....	....	−103·0	½	....	....	−90·1	¼		
Weighted mean	− 83·92		− 79·47		+ 44·88		− 90·56		+ 75·27		− 87·87		+ 54·44	
V_a	+ 4·53		+ 3·56		+ 3·56		+ 3·24		+ 3·24		+ 3·24		+ 3·24	
V_d	− 0·17		+ 0·06		+ 0·06		− 0·06		− 0·06		− 0·18		− 0·18	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	− 79·8		− 76·1		+ 48·2		− 87·7		+ 78·2		− 85·1		+ 57·2	

MEASURES OF BOSS 5173—*Continued*

λ	7770		7772		7772		7777		7777		7778		7778	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4584	−31·0	½												
4572	36·1	¼												
4549	21·8	½	−56·4	¼			−123·4	¼	+70·1	¼	−80·9	½		
4534	27·5	¼												
4481	26·2	¾	53·9	½	+33·8	¼	98·2	½	84·0	¼	94·2	½	+61·1	½
4415	7·7	¼					98·2	¼					50·4	½
4404							73·3	½	49·3	¼				
4352							58·6	¼						
4340	27·6	¼	66·7	¼	66·4	¼					51·6	¼	91·4	½
4325	2·6	½	90·4	¼	19·2	¼	101·5	¼	54·2	¼				
4308	35·6	¼	61·5	¼	53·8	¼	64·1	¼	57·6	¼	73·1	¼	70·3	½
4300	3·0	½												
4271	18·6	½	68·4	¼							102·9	½		
4260											91·7	¼		
4236	60·6	¼							45·4	¼				
4233	12·5	½	39·2	¼	77·2	¼	132·1	¼	59·1	¼				
4227	27·6	½												
4198											78·9	¼		
4143					59·2	¼					89·8	¼	+82·5	¼
4077	2·4	½	−61·3	½	+86·7	¼								
4063	8·6	½												
4045	−10·0	½					−55·5	¼	+41·6	¼	−101·7	¼		
Weighted mean	− 18·95		− 61·32		+ 56·61		− 88·70		+ 57·66		− 86·87		+ 74·53	
V_a	+ 0·75		+ 0·34		+ 0·34		− 3·38		− 3·38		− 3·38		− 3·38	
V_d	− 0·22		0·00		0·00		− 0·07		− 0·07		− 0·22		− 0·22	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	− 18·7		− 61·3		+ 56·7		− 92·4		+ 53·9		− 90·8		+ 70·6	

MEASURES OF BOSS 5173—*Continued*

λ	7793		7793		7794		7794		7801		7801		7804	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4584	......	...	......	...	......	...	......	...	+58·7	¼	−86·7	¼	......	...
4549	+63·2	½	−63·6	¼	−62·0	¼	+77·7	¼	81·9	¼	59·8	¼	−95·7	¾
4534	......	...	......	...	40·6	¼	......	...	......	...	......	...	......	...
4522	56·9	½	67·6	½	......	...	......	...	......	...	......	...	......	...
4520	......	...	......	...	......	...	69·6	¼	......	...	......	...	......	...
4481	46·1	½	90·4	½	69·1	½	......	...	......	...	......	...	87·0	¼
4415	......	...	......	...	61·6	¼	73·7	¼	75·6	¼	......	...	......	...
4404	......	...	......	...	73·5	¼	......	...	......	...	......	...	......	...
4395	......	...	......	...	......	...	......	...	......	...	73·4	¼	......	...
4352	......	...	......	...	......	...	......	...	......	...	......	...	73·4	½
4340	46·8	½	......	...	......	...	......	...	......	...	......	...	75·9	¼
4325	37·4	¼	......	...	......	...	39·7	¼	......	...	......	...	......	...
4308	......	...	......	...	82·6	¼	64·1	¼	68·9	¼	......	...	......	...
4300	26·2	¼	......	...	......	...	......	...	......	...	......	...	......	...
4271	60·0	¼	66·3	½	......	...	......	...	69·7	¼	......	...	93·7	½
4260	72·6	¼	86·0	¼	......	...	......	...	......	...	......	...	......	...
4250	......	...	......	...	......	...	......	...	71·8	¼	......	...	......	...
4236	......	...	......	...	......	...	101·0	¼	......	...	......	...	......	...
4233	60·6	½	......	...	......	...	......	...	......	...	......	...	73·1	¼
4227	36·3	¼	119·6	¼	......	...	......	...	......	...	92·1	¼	76·5	½
4215	......	...	......	...	......	...	......	...	81·8	¼	......	...	......	...
4143	24·5	½	......	...	......	...	......	...	......	...	......	...	......	...
4071	67·3	¼	70·3	¼	......	...	......	...	+90·7	¼	−58·1	¼	......	...
4063	59·2	¼	−91·2	¼	72·5	¼	64·7	¼	......	...	......	...	......	...
4045	+31·8	¼	......	...	69·0	¼	+33·7	¼	......	...	......	...	−95·7	¼
4005	......	...	......	...	−76·1	¼	......	...	......	...	......	...	......	...
Weighted mean	+ 49·30		− 79·98		− 67·52		+ 65·52		+ 74·89		− 74·02		− 85·14	
V_a	− 5·08		− 5·08		− 6·10		− 6·10		− 11·10		− 11·10		− 12·11	
V_d	− 0·04		− 0·04		+ 0·02		+ 0·02		− 0·04		− 0·04		− 0·16	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	+ 43·9		− 85·4		− 73·9		+ 59·2		+ 63·5		− 85·4		− 97·7	

MEASURES OF BOSS 5173—*Continued*

λ	7804		7822		7836		7836		7847		7847		7876	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4572									+81·3	½				
4549			+17·4	¼	+74·7	½			44·4	½				
4534					83·7	½	−89·5	¼						
4481			+ 5·2	½	71·8	½	30·6	¼	54·9	½	−63·0	½	+95·0	½
4415					78·7	¼								
4352	+86·6	¼							76·5	½				
4340	84·7	¼	−12·2	¾	63·1	¼					39·8	¼		
4325	96·6	¼	+14·2	½	74·4	¼			39·9	¼			81·0	½
4308													63·0	½
4300													55·3	¼
4271			− 5·6	½	80·4	½	67·4	¼					+62·4	¼
4260							81·0	¼						
4236			−14·5	½	107·9	¼								
4233			+ 8·4	½			64·4	¼			67·6	½		
4227	82·2	¼	−17·9	¼										
4215			−11·6	¼										
4198			+ 2·8	½										
4143					82·5	½	111·6	¼						
4077					66·8	¼	74·1	¼	67·2	½	50·9	¼		
4063									79·1	¼	48·3	¼		
4045	+84·5	¼	−26·3	¾	88·3	¼	−60·1	¼	+54·9	¼	−67·7	½		
4005					+65·2	½								
3933			− 0·1	½										
Weighted mean	+ 86·92		− 4·61		+ 77·53		− 72·34		+ 63·23		− 59·51		+ 74·45	
V_a	− 12·11		− 17·31		− 17·72		− 17·72		− 18·07		− 18·07		− 19·38	
V_d	− 0·16		+ 0·03		− 0·12		− 0·12		0·00		0·00		− 0·11	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	+ 74·4		− 22·2		+ 59·4		− 90·5		+ 44·9		− 77·9		+ 54·7	

MEASURES OF BOSS 5173—*Continued*

λ	7876		7888		7888		7915		7919		7940		7940	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4572									− 7·3	½				
4549	−81·3	¼			−69·6	¼	+ 4·4	¼	− 1·3	½	+63·0	¼	−107·6	½
4501			+118·3	¼										
4481	77·5	¼					−12·1	¼	+13·8	½	77·6	¼	81·9	½
4352									− 1·7	¼	90·4	¼	−57·1	½
4340	66·4	¼									85·2	¼		
4325	80·3	¼			38·8	½					76·2	¼		
4315	104·4	¼												
4308	105·8	¼			76·3	¼								
4300	107·5	¼							+ 0·8	¼				
4271	114·2	¼							− 7·2	½				
4236			77·7	½										
4233					−71·9	½			−31·2	½				
4143							−14·9	¼	−10·9	½				
4077											66·2	¼		
4071			+82·7	¼										
4045	−97·3	¼							−30·8	¼	+76·9	¼		
Weighted mean	− 92·74		+ 89·10		− 61·27		− 7·53		− 7·95		+ 76·76		− 77·93	
V_a	− 19·38		− 21·02		− 21·02		− 19·98		− 19·62		− 15·55		− 15·55	
V_d	− 0·11		− 0·04		− 0·04		− 0·14		− 0·14		− 0·20		− 0·20	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	−112·5		+ 67·8		− 82·6		− 27·9		− 28·0		+ 60·7		− 94·0	

MEASURES OF BOSS 5173—*Continued*

λ	7952		8219		8219		8233		8233		8245		8245	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4584	+ 1·7	⅓												
4572	15·1	⅓	−77·9	½										
4549	11·1	⅓	98·5	⅓	+55·7	¼	−70·1	¼	+74·8	½	−92·3	½	+57·4	½
4534	5·5	⅓												
4481	20·6	⅓	80·1	¼	58·9	¼	68·3	⅓	95·3	½	103·9	½	53·4	½
4352	13·9	⅓												
4340			85·4	¼			91·4	⅓			−105·1	⅓	+87·9	½
4325	9·1	⅓												
4271	6·5	⅓												
4236	16·7	¼												
4227	+25·4	¼												
4215			94·7	¼										
4202			88·0	¼	42·7	¼								
4143							59·0	¼	+76·8	½				
4101							90·3	¼						
4077							88·2	⅓						
4071			−95·8	¼	+23·2	¼	47·9	¼						
4063							−54·6	⅓						
Weighted mean	+ 11·56		− 87·88		+ 45·12		− 72·70		+ 82·30		−101·60		+ 66·23	
V_a	− 14·78		+ 9·79		+ 9·79		+ 4·30		+ 4·30		+ 6·16		+ 6·16	
V_d	− 0·22		− 0·07		− 0·07		− 0·07		− 0·07		+ 0·02		+ 0·02	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	− 3·7		− 78·4		+ 54·6		− 68·7		+ 86·2		− 95·7		+ 72·1	

MEASURES OF BOSS 5173—*Continued*

λ	8260		8260		8264		8264		8280		8280		8281	
	Vel.	Wt	Vel.	Wt	Vel.	Wt.	Vel.	Wt	Vel.	Wt.	Vel.	Wt	Vel.	Wt.
4549			−127·6	¼	−81·1	¼			+80·2	¼	−85·3	¼	+58·5	¼
4481 ..	+60·8	½	105·8	½	109·9	¼			62·0	½	−107·0	½		
4415 ..					−75·9	½	+65·6	¼						
4308 ..			101·0	¼										
4271 ..									90·2	½				
4236 .									+91·7	½				
4045 .	+78·5	¼	−64·1	¼										
Weighted mean	+ 66·70		−100·80		− 85·80		+ 65·60		+ 81·14		− 99·77		+ 58·50	
V_a	− 0·85		− 0·85		− 2·23		− 2·23		− 10·23		− 10·23		− 10·53	
V_d	− 0·02		− 0·02		+ 0·02		+ 0·02		− 0·14		− 0·14		+ 0·04	
Curv.	− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28		− 0·28	
Radial Velocity	+ 65·6		−102·0		− 88·3		+ 63·1		+ 70·5		−110·4		+ 47·7	

MEASURES OF BOSS 5173—*Continued*

λ	8291		8201		8295		8306		8311		8311		8321	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt
4584									−82·0	½	+ 47·3	¼		
4549	−96·2	½					+ 6·6	¼					−81·9	½
4481	−137·4	¼	+57·7	¼			−25·0	¾	76·4	½	+103·1	½	83·9	¾
4352							− 4·1	½						
4325							+ 6·2	½						
4308													47·9	¼
4271					+71·0	¾								
4236													71·0	½
4233							− 4·7	¼					76·0	½
4227							− 6·5	½						
4143													−77·8	½
4045							−12·3	½	−75·4	½				
Weighted mean	−109·93		+ 57·70		+ 71·00		− 8·18		− 77·93		+ 84·50		− 76·13	
V_a	− 11·73		− 11·73		− 12·61		− 15·[illegible]		− 16·43		− 16·43		− 19·75	
V_d	− 0·14		− 0·14		− 0·19		− 0·[illegible]		− 0·18		− 0·18		− 0·14	
Curv.	− 0·28		− 0·28		− 0·28		− 0·2[illegible]		− 0·28		− 0·28		− 0·28	
Radial Velocity	−122·1		+ 45·6		+ 57·9		− 24·6		− 94·8		+ 67·6		− 96·3	

MEASURES OF BOSS 5173—*Concluded*

λ	8321		8344											
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4549			+ 8·2	½										
4481	+116·2	¾	+ 4·6	¾										
4325			+18·8	½										
4271			− 2·2	¼										
4250			+14·6	¼										
Weighted mean	+116·20		+ 8·89											
V_a	− 19·75		− 20·91											
V_d	− 0·14		− 0·14											
Curv.	− 0·28		− 0·28											
Radial Velocity	+ 96·0		− 12·4											

NORMAL PLACES OF BOSS 5173

No.	Mean Phase	Mean Velocity	Weight	Residual	
				Preliminary	Final
1	1·015	− 74·3	3	+ 5·5	+ 1·7
2	1·493	− 92·1	1	− 2·2	− 4·2
3	1·926	− 91·8	3	0·0	− 0·1
4	2·592	− 84·2	2	− 2·3	+ 0·5
5	4·151	− 8·2	1	+11·0	+13·3
6	5·653	+ 52·2	1·5	+ 7·5	+ 4·5
7	6·409	+ 65·0	2	+ 4·6	+ 1·0
8	6·989	+ 60·2	2	− 0·5	− 3·5
9	7·589	+ 53·6	2·5	+ 4·8	+ 2·9
10	9·165	− 11·3	1·5	+15·3	+11·7
11	1·019	+ 59·1	2	− 0·6	+ 2·7
12	1·450	+ 66·4	1	− 4·0	− 2·0
13	1·965	+ 71·6	1·5	− 1·4	− 2·0
14	2·504	+ 58·7	1·5	− 5·8	− 9·1
15	4·151	− 8·2	0·5	+ 0·4	− 4·5
16	5·669	− 86·7	1·5	− 5·8	− 6·3
17	6·437	−101·4	1·5	− 2·9	− 3·4
18	6·943	− 97·9	1	+ 1·0	− 0·2
19	7·634	− 83·3	2	+ 0·3	− 1·5
20	9·165	− 11·3	1	−11·1	− 9·4

Preliminary elements were obtained as in the following table.

ELEMENTS OF BOSS 5173

Element	Preliminary	Final
P	9·316 days	9·316 days
e	0·04	0·012
ω	105°	103°·15
ω_1	285°	283°·15
K	77 km.	78·49 km.
K_1	86·7 km.	86·31 km.
γ	−14·20 km.	−13·04 km.
T	J. D. 2,420,304·628	J. D. 2,420,304·628
$a \sin i$		10,054,000 km.
$a_1 \sin i$		11,055,000 km.
$m \sin^3 i$		2·27 $\odot$
$m_1 \sin^3 i$		2·06 $\odot$

The period was considered fixed from the early observations. Observation equations were built up in the usual way for the other elements and a solution effected. Corresponding to the normal places at the intersections of the curves an observation equation, suitably weighted, was formed for both primary and secondary. Making the substitutions,

$$\begin{aligned} x &= \delta\gamma \\ y &= \delta K \\ y_1 &= \delta K_1 \\ z &= 100\ \delta e \\ u &= 100\ \delta\omega \\ v &= [1.83000]\ \delta T \end{aligned}$$

the following observation equations resulted. Owing to the similarity of coefficients for ω and T, it was found necessary to consider T as fixed.

OBSERVATION EQUATIONS OF BOSS 5173

No.	x	y	y_1	z	u	$-n$	Weight
1	1·000	−0·851		−·769	−·447	− 5·50=0	·3
2	1·000	−0·983		−·514	−·207	+ 2·20	·1
3	1·000	−1·008		−·096	+·022	0·00	·3
4	1·000	−0·879		+·536	+·351	+ 2·30	·2
5	1·000	−0·064		+·270	+·738	−11·00	·1
6	1·000	+0·765		−·761	+·457	− 7·50	·15
7	1·000	+0·970		−·472	+·123	− 4·60	·2
8	1·000	+0·973		+·080	−·170	+ 0·50	·2
9	1·000	+0·819		+·621	−·460	− 4·80	·25
10	1·000	−0·161		−·028	−·791	−15·30	·15
11	1·000		+0·852	+·865	+·501	+ 0·60	·2
12	1·000		+0·975	+·620	+·259	+ 4·00	·1
13	1·000		+1·006	+·096	−·048	+ 1·40	·15
14	1·000		+0·907	−·524	−·348	+ 5·80	·15
15	1·000		+0·064	−·304	−·831	− 0·40	·05
16	1·000		−0·770	+·857	−·508	+ 5·80	·15
17	1·000		−0·973	+·508	−·124	+ 2·90	·1
18	1·000		−0·978	−·036	+·164	− 1·00	·1
19	1·000		−0·801	−·732	+·541	− 0·30	·2
20	1·000		+0·161	+·032	+·890	+11·10	·1

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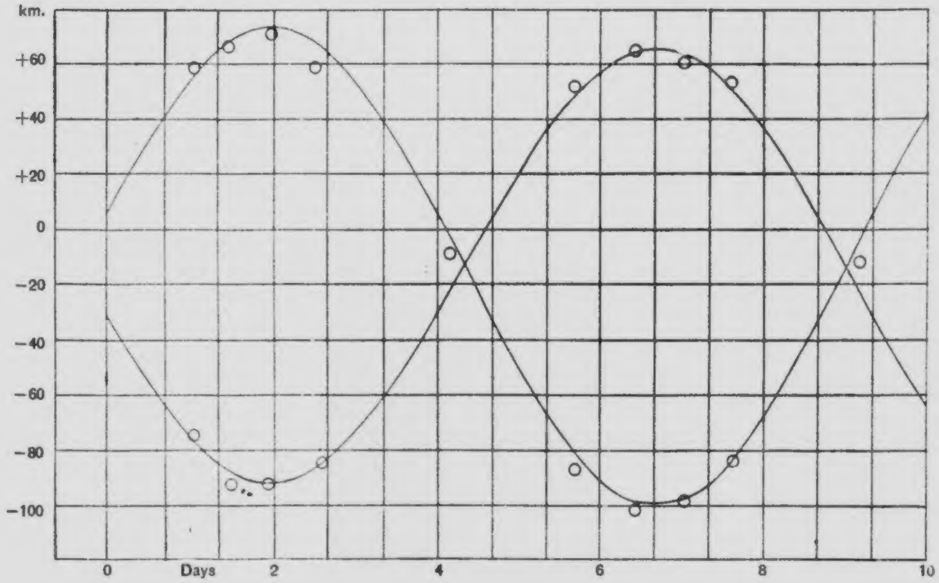
NORMAL EQUATIONS

$$
\begin{array}{rrrrrr}
3\cdot 300x & -0\cdot 153y & +0\cdot 054y_1 & -0\cdot 005z & -0\cdot 031u & -3\cdot 675=0 \\
 & 1\cdot 412y & 0\cdot 000y_1 & +0\cdot 146z & +0\cdot 028u & -1\cdot 420=0 \\
 & & 0\cdot 972y_1 & +0\cdot 099z & +0\cdot 040u & +0\cdot 725=0 \\
 & & & 0\cdot 991z & +0\cdot 026u & +2\cdot 695=0 \\
 & & & & 0\cdot 617u & +2\cdot 076=0
\end{array}
$$

Small corrections were thus obtained; the corrected or final values being given in the table above. The probable error of a plate is for the primary ±4·8 km. per sec., and for the secondary ±6·9 km. per sec. All plates were measured twice, the second measurement being made several months after the first, the means of the two measures for the various lines are given in the detailed measures.

Dominion Observatory
Ottawa
January, 1918.



Velocity Curves of Boss 5173